

**Study  
Report  
98-06**

## **Issues and Recommendations: Training the Digital Force**

**Roy Campbell, Laura Ford, Michael Shaler, and  
Robert Cobb**

Human Resources Research Organization

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**Study Report 98-06**

## **Issues and Recommendations: Training the Digital Force**

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## FOREWORD

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A primary mission of the Armored Forces and Infantry Forces Research Units of the United States Army Research Institute for the Behavioral and Social Sciences is to gather and analyze data on personnel and training that will provide the Army with timely information on which to base future planning and policy making.

Acting upon a request from Headquarters, Department of the Army, this study was sponsored by the Department of the Army's Director of Personnel Technologies. A Memorandum for Record between the Office of the Deputy Chief of Staff for Personnel, the U.S. Total Army Personnel Command, the Training and Doctrine Command System Managers for the Bradley Fighting Vehicle System and the Abrams Tank System, and the U.S. Army Research Institute supported this effort. This study was conducted under the Science and Technology Task 2135, "Back-up Training Requirements for the Digitized Battlefield."

This report provides the outcomes of a study of the impact that digitization will have on training the force. The approach was a critical examination of where the Army is and where it needs to be heading as it embraces increasing digital capabilities. An important component of this study was the inclusion of back-up skill requirements as an integral part of digitization. Back-up skills are those needed by soldiers to operate when digital systems are degraded or unavailable. The study revealed that there are major issues that must be addressed if training and personnel considerations are to balance technological advances that typify digital applications. It identifies back-up as a critical but currently nonexistent component of the training paradigm. Major recommendations are matched with each issue identified.

The Army leadership and policy makers can use this report to help focus attention on training issues and areas that require decisions and continued investigation.

ZITA M. SIMUTIS  
Technical Director

# ISSUES AND RECOMMENDATIONS: TRAINING THE DIGITAL FORCE

## EXECUTIVE SUMMARY

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### Study Requirements:

Digitization is the future of the Army. Along with digitization come training and personnel implications. Acting on a request of the Department of the Army's Director of Personnel Technologies, the United States Army Research Institute for the Behavioral and Social Sciences sponsored a study to identify the training issues associated with digitization, specifically those that address the need to train and maintain back-up skills along with digital skills. Knowledge of back-up procedures is required for soldiers to accomplish tasks when digital systems are degraded or unavailable.

### Procedure:

Using the M1A2 Abrams Main Battle Tank and the M2A3 Bradley Fighting Vehicle as exemplar systems, the study explored issues that were applicable to a wide range of digital applications and training situations. The study utilized a series of expert groups to define the issues and formulate recommendations. These groups included users, developers, researchers, and trainers with a wide spectrum of experiences and viewpoints. The expert group input was used to identify the issues or impacts that the Army faces as it transitions from a conventional to a digital force. Subsequent expert groups analyzed the issues and suggested possible solution sets. The solution sets were researched and analyzed by staff analysts in order to synthesize recommendations for each issue.

### Findings:

Fifteen primary issues associated with the digitization of the battlefield were identified. These digital and back-up issues are those that warrant high level Army attention and are generalizable to a wide range of digital systems. The 15 issues were organized into the following categories:

- Operational Concepts and Developmental Issues - addresses six issues arising from the introduction of digitized units into Army operations and the resulting requirement for back-up training.
- Institutional Issues - focuses on two issues facing institutional training as digital and back-up skill requirements emerge.
- Unit Issues - presents two issues regarding units' new role in training the digital Army.
- Training Pillar Issues - addresses two issues that need to be considered as the Army redefines the institutional, unit, and self-development pillars.
- Strategic Analysis Issues - describes three analytic areas associated with digitization that require further analysis.

Each issue is accompanied by specific recommendations. Because the selected issues were complex, most of the recommendations address broad policy decisions. However, the expert groups also recognized the need to make recommendations that could have an immediate discernible impact. Therefore, three examples of detailed, practical recommendations are included.

#### Utilization of Findings:

The purpose of this report is to lay out the training situation as it relates to the conventional-to-digital transition, to identify issues that impact training, and to propose recommendations and suggest areas for further examination. This report is intended to highlight and present the conclusions of greatest impact derived from the study.

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# INTRODUCTION

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## Background

The United States (U.S.) Army has made a substantial investment and a strong institutional commitment to harnessing the power of the microprocessor to provide significant advantages on the battlefield. The areas of command and control, situational awareness, target acquisition and identification, and improved system lethality--all have been affected and influenced by the new-found power of the microprocessor. This entire effort has come under the heading of "digitization." Digitization is defined as "the application of technologies to acquire, exchange, and employ timely digital information throughout the battlespace, tailored to the needs of each decider (commander), shooter, and supporter . . . allowing each to maintain a clear and accurate vision of common battlespace necessary to support both planning and execution."<sup>1</sup> Digitization also impacts the way the Army operates: the way soldiers perform their individual and collective tasks, and the way missions are accomplished.

The need to address personnel and training issues as a part of digitization was established by the Department of the Army's (DA) Director of Personnel Technologies (PerTech). The focus of the Director's request was the requirement to train digital skills while also training and maintaining conventional skills to back-up degraded digital capabilities. His challenge was that the "early identification of issues is essential to minimize long-term program costs and avoid potential roadblocks to implementation."<sup>2</sup>

The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) responded to the PerTech request by directing that a study be conducted. The study examines digital and back-up training. It was established that the outcome should be the identification of significant issues which may demand complex solutions.

The purpose of this report is to lay out the training situation as it relates to the conventional-to-digital transition, to identify issues that impact training, and to propose recommendations and suggest areas for further examination. This report is intended to highlight and present the conclusions of greatest impact derived from the study. The more detailed presentation of the study itself is contained in

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<sup>1</sup> U.S. Army Digitization Office (September 1997). ADO Home Page [On-line]. Available: <http://www.ado.army.mil/smrbook/sbgif2.htm>

<sup>2</sup> MANPRINT (June 1996). Office of the Deputy Chief of Staff for Personnel, Request Memorandum.

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## **Scope**

The ARI approach for this study was to identify and examine back-up training issues by utilizing two digitized systems as examples: the M1A2 Abrams Main Battle Tank (MBT), which is a fielded system, and the M2A3 Bradley Fighting Vehicle (BFV), which is a system currently in development with unit fielding scheduled to begin in the year 2000.

The fielding of the M1A2 tank provided a logical avenue of investigation. This digital vehicle has been through operational testing and evaluation and has been in the hands of troops since mid-1995. Therefore, many concerns have already been explored or uncovered by the M1A2 program. Both the M1A2 and the M2A3 are exemplar systems in that they affect multiple levels of employment--individual operator through battalion--and interact with all battlefield operating systems (BOS). Many of the issues and recommendations for this report came about through the study of these exemplar systems.

The study was never intended to limit the scope or findings to just those systems. Therefore, this report reflects the training impact that the Army as a whole faces as it moves toward increased digitization.

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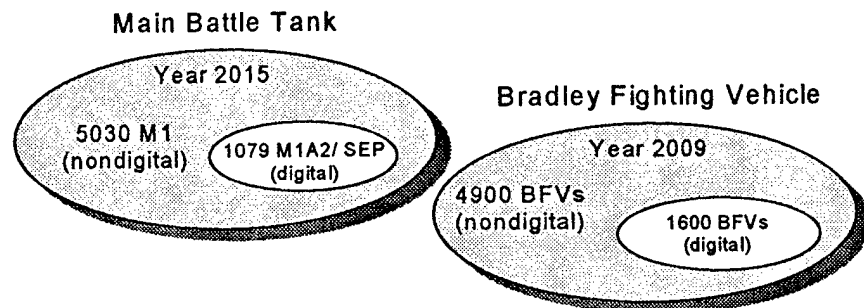
## **Operational Requirements of the Digital Force Include Back-Up Skills**

Digitization of the battlefield will require that individual and collective digital tasks and functions be defined. Digital skills will encompass tasks ranging from operation of new devices to new tactics, techniques, and procedures (TTPs). Although digitization will lead to the automation of many tasks that are currently performed through manual or personnel intensive means, there is still a requirement for soldier-in-the-loop performance. Operational requirements dictate that for the foreseeable future there will be a need for both digitized *and* back-up or conventional operations. Back-up skills are those needed by soldiers to operate when digital systems are degraded. Outlined below are three primary circumstances that generate the need for maintaining back-up skills.

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<sup>3</sup> Ford, L. A., Campbell, R., & Cobb, R. (in preparation). Analysis of Emerging Digital and Back-up Training Requirements (ARI Study Report). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

- **Degraded operation.** No system is 100% reliable. Degraded and compromised operations include mechanical, electrical, electromagnetic, and software failures due to battle damage, environmental conditions, or intentional disruption by the enemy. Redundancy is expensive and very often an engineering challenge.
- **Mixed equipment and capabilities.** Forces generally operate at the lowest common denominator that unites them. For the foreseeable future, the Army's inventory of vehicles, equipment, systems, and devices will contain a variety of capabilities ranging from completely digitized to completely manual. For example, out of the total inventory of about 7000 Army tanks in the year 2015, only 1079 will be M1A2 and M1A2 System Enhancement Program (SEP) tanks. In the year 2009, approximately 1600 out of 6500 BFVs will be the M2A3 digitized version. While the interface between systems will inevitably improve, a completely compatible, digitized force will probably not be achievable in the twenty-year projection.



- **Training up and training down.** With the drawdown of military units, the emphasis for force projection is on the rapid deployment of forces without their heavy equipment, followed by the issuance of equipment in the deployment area. Often the pre-positioned equipment does not match the equipment the unit trained on before deployment. The requirement then, is to cycle between training "up" to more sophisticated systems and training "down" to older or more basic systems.

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## **Environment, Restrictions, and Parameters**

The recommendations resulting from this study were developed and refined with regard for the parameters within which the Army must operate--now and in the near future. While Army resources are decreasing and military and civilian personnel are being downsized, training requirements are increasing; technologies are changing rapidly and units are being deployed to increasingly complex operating environments.

The impact of these factors on the Army results in the requirement to do more with less. Training and Doctrine Command's (TRADOC) institutions are facing, and may continue to face, sizable cuts in their training resources. Units are likewise confronted with increasing operational commitments and decreasing training resources.

The contributors to this study were cognizant of such real life constraints throughout. Solutions requiring high dollar expenditures, increases in manpower levels, or inordinate time requirements were considered unsuitable and unrealistic.

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## **Report Organization**

This report summarizes an effort that explored many facets of a complex problem. It is intended to provoke thought, discussion, and activity. Fifteen issues and corresponding recommendations are presented under the following five topic headings:

- Operational Concepts and Development Issues
- Institutional Issues
- Unit Issues
- Training Pillar Issues
- Strategic Analysis Issues

These issues and recommendations are followed by a summary of the study conclusions and a description of the study methodology.

## ISSUES AND RECOMMENDATIONS

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### Operational Concepts and Developmental Issues

The introduction of additional digitized units into Army operations will have a significant effect on how the Army fights and develops its doctrine and training strategies for many years to come. Much has already been discovered; much more will be learned in the future. One thing is clear: The "old ways" of doing business will not fit in the digital Army. The study identified six particular issues that highlight this area.

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### The Army Has Not Addressed Back-Up as a Significant Training Issue

With the introduction of digitization, there has been a tendency to think of changes in training only in terms of how to operate new equipment or software in its fully operational mode. But the requirements need to be expanded to consider back-up skills. Equipment reliability and the prospect of operating with mixed forces dictate that training back-up skills will be a requirement for the foreseeable future. Yet, this is an area currently without a comprehensive training strategy. As capabilities and technologies change, the characteristics of back-up training will also change. For example, training requirements may well evolve from manual back-up techniques to redundant digital systems.

*Consider the soldier of the not too distant future who is trained to navigate by satellite but has never learned to navigate using a topographic map, compass, or terrain association.*

The Army cannot assume that learning and retraining of back-up tasks will just "be there." Such an assumption is unwarranted. There must exist a coherent training strategy. The problem will be exacerbated as digital systems proliferate and "digital soldiers" become the norm. From their earliest Army training, digital soldiers will be oriented to perform in a digital mode, but they may never, in peacetime, widely experience and internalize performance in a non-digitized environment. Consider, for example, the soldier of the not too distant future who is skilled on navigating by satellite but has never had to rely on a topographic map, compass, and terrain association as the basis for navigation. These nondigital skills, if they are deemed important for battlefield success, must be addressed during peacetime training.

Even among soldiers who have learned the back-up modes of performance, but who operate in a digital mode, there is a problem with skill retention and retraining. The back-up skills that soldiers currently have will erode as the requirements are performed with less frequency.

One of the participants in the initial digital operations Advanced Warfighter Experiment (AWE) (Desert Hammer) observed: "Our soldiers can learn digital proficiency but require continual emphasis on default proficiency. Soldiers default to their comfort zone in times of high stress."<sup>4</sup>

#### **RECOMMENDATION:**

#### **ISSUE: The Army Has Not Addressed Back-Up as a Significant Training Issue**

Digital and back-up training must go hand-in-hand. Back-up analysis must become part of the mindset of decision makers from conceptualization of digital systems through implementation. Back-up consideration must be integrated into:

- Procurement and development processes
- Doctrine development
- Task analysis (individual and collective)--See the example of back-up requirements analysis for the M1A2 in Application A
- Training development

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<sup>4</sup> Edwards, O. T, III (May-June 1995). "Digital battlefield training and insights of a user (NTC Rotation 94-07)." Armor, p. 13.

## Training Requirements Analysis

A methodology was developed to identify the back-up training requirements for soldiers operating in M1A2 units. The process utilized existing tasks that were analyzed to identify:

- Digital performance requirements
- Digital systems used to accomplish the task
- Back-up requirements when digital systems are degraded or cannot be used

By examining aspects of M1A2 digital performance requirements, the performance skills necessary to operate the M1A2 in degraded modes were identified. The following example illustrates an application of the methodology to an individual/crew task.

### Individual/Crew--M1A2 Task

**171-126-1130 Send and Receive Tactical Reports/Overlays on the Commander's Integrated Display (CID)**

**Digital performance requirements:**

The CID and Intervehicular Information System (IVIS) are used to prepare, send, and receive tactical reports and overlays. The Position/Navigation (POS/NAV) provides automated grid locations to the reports and overlays.

**Digital systems used:<sup>a</sup>**

X	CID		CITV		GCDP
X	IVIS		DID	X	POS/NAV

**Back-up requirements:**

If POS/NAV is inoperable the reports and overlays can be utilized if the commander manually inputs grid locations. Position can be obtained from the Precision Lightweight GPS Receiver (PLGR) or another vehicle. If the radios are inoperable digital reports/overlays can be prepared on the CID but cannot be sent digitally nor can they be received. In this case, reports and overlays have to be constructed and sent in conventional manner (paper and acetate). The conventional tasks include:

- 171-121-4051 Prepare a Situation Report/Status Report
- 171-123-4001 Prepare a Platoon Fire Plan
- 171-126-1042 Prepare a Sketch Range Card
- 01-5700.01-0001 Communicate on a Tactical Radio
- 051-196-3009 Prepare a Route Reconnaissance Overlay
- 061-283-1002 Locate a Target by Grid Coordinates
- 071-329-1002 Determine the Grid Coordinates of a Point on a Military Map
- 071-329-1019 Use a Map Overlay
- 081-831-0101 Request Medical Evacuation
- 171-121-4053 Plan an Armor/Scout Platoon Tactical Roadmarch
- 301-348-1050 Report Information of Potential Intelligence Value.

<sup>a</sup> Intervehicular Information System (IVIS), Commander's Independent Thermal Viewer (CITV), Driver's Integrated Display (DID), Gunner's Control Display Panel (GCDP), Position Navigation (POS/NAV).

Application A: Detailed example of back-up training requirements analysis recommended for all digital tasks.



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**Training  
Development Is  
Outpaced by Digital  
Systems  
Development**

A dominant characteristic of information age technology is how rapidly it changes. Hardware and software are evolving at a pace heretofore unknown in the military equipment and systems acquisition cycle. Colonel Tom Metz from the TRADOC Experimental Force (EXFOR) Coordination Cell stated it most clearly: "In the industrial age you were able to describe an end state, and over a long period of time you were able to achieve it in a very sequential way. In the information age, on the other hand, you don't necessarily know what the end state will be because you're learning so much through the process. We can't decide to buy a system for a 20-year life span because the hardware and software turnover is at 20 times the 20-year life span."<sup>5</sup>

*"We can't decide to buy a system for a 20-year life span because the hardware and software turnover is at 20 times the 20-year life span."*

-- COL Tom Metz

The development of training for new systems is currently dependent on the Army Life Cycle Model (LCM), which "... outlines the life cycle of the Army acquisition system and materiel concept investigation, through development and acquisition, until ultimate phase out and disposal. Materiel acquisition initiates training requirements."<sup>6</sup> This acquisition model is based on a series of discrete and sequential steps that culminate with a final, fielded product. Throughout the acquisition process, TRADOC proponents are responsible for ensuring that training developers provide input and that the input is considered early in the acquisition cycle. This process implies a fixed endpoint in acquisition. However, the time-consuming process of "bending metal" is no longer necessary to change the functionality of a system. New software alters system capabilities, and in turn training requirements, in a fraction of the time required to manufacture a system in the industrial age. The fixed endpoint of acquisition is being replaced by one of continuous development. The LCM cannot accommodate the fast-paced, continually changing environment of digital technology.

Compounding compressed development times is the fact that programs that have been put in place to maximize performance of soldier-machine systems, such as Manpower and Personnel Integration (MANPRINT), are not always being utilized appropriately. Proponent agency training developers are supposed to "be involved in the training aspects of MANPRINT during systems development."<sup>7</sup> Yet, many times these requirements are waived and compromised for new systems to be developed rapidly on tight budgets.

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<sup>5</sup> TRADOC News Service (4 March 1997). Release No.: 97-03-02, Author: J. Caldwell, Ft Monroe, VA.

<sup>6</sup> Department of the Army (24 September 1995). TRADOC Regulation 350-70, Fort Monroe, VA, p. IV-3-3.

<sup>7</sup> *ibid.*

At least one program has been initiated to speed up the materiel acquisition process. The Wartime Rapid Acquisition Program (WRAP) was designed to accelerate the acquisition process for new pieces of military equipment that show outstanding performance in experimental settings such as the AWE and Battle Lab activities.<sup>8</sup> Accelerated materiel acquisition is needed, but without a concentrated effort to match it with training development, the process will be self-defeating when the equipment reaches the troops.

**ISSUE: Training Development Is Outpaced by Digital Systems Development**

**RECOMMENDATIONS:**

- 1) Critically review and revise the systems acquisition model to ensure it is compatible with the fast paced, continuous development that is the trademark of information age technology.**
- 2) Incorporate early identification and integration of training requirements into the systems acquisition model. The model must support simultaneous and continuous integration between training developers and technology developers:**
  - Maximize creation of contractor, combat development, and training development teams in permanent relationships at the earliest possible point in the procurement process.**
  - Enforce adherence to existing and new requirements for training and procurement integration.**
  - Maximize the use of simulation focused on the early identification of training requirements**

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**The Army Does Not Have Doctrine for Fighting Digitized Units**

The concepts of how to fight digital systems have been slow to evolve. In 1994, Colonel John Johnston, then Director of the Armor School, identified that "our basic fighting doctrine is changing. The fighting formations that we know today, especially in the defense, will likely change because digitization allows for the rapid movement and concentration of forces."<sup>9</sup> Almost four years later, little has been done to define digital fighting doctrine, to include integration of systems, degraded operations, and mixed forces operations.

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<sup>8</sup> "AWE may lead to procurement review." *Jane's Military Exercise & Training Monitor*, January-March 1997, p. 4.

<sup>9</sup> Johnston, J. C. (March-April 1994). "The Journey to Force XXI's Mounted Component." *Armor*, p. 15.

*"The fighting formations that we know today . . . will likely change because digitization allows for the rapid movement and concentration of forces."*

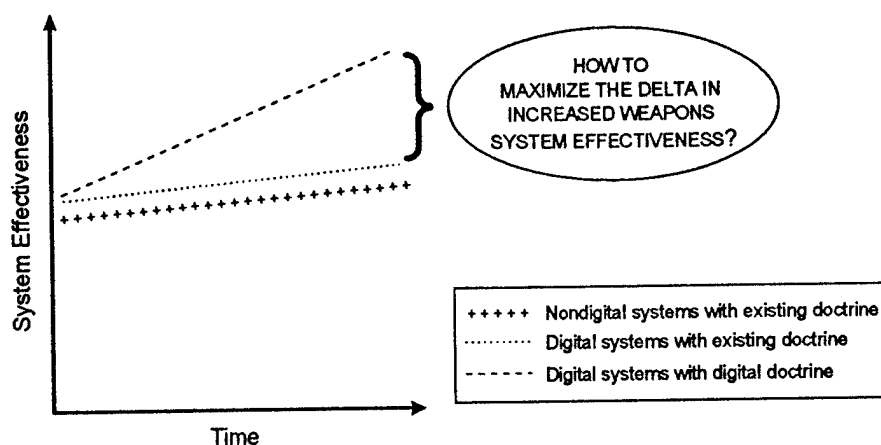
-- COL John Johnston

One conclusion of the expert groups assembled for this study was that doctrinal advances have not been made because the approach has been to retrofit digital operations into current doctrine without considering the full capability or potential of the digital systems. The true exploitation of digital systems will come only when developers rethink how digital systems can significantly increase operational effectiveness. So far, digital "how to fight" doctrine is not keeping pace with the capabilities of the new systems.

The graph in Figure 1 represents the potential increase in weapon system effectiveness with the introduction of doctrine that specifically addresses the capabilities that digital systems afford. Using conventional doctrine for digital systems does little to increase operational effectiveness.

Initial concepts of small unit operations, company and task force, were first put forth in special text and supplemental material publications in December 1995<sup>10</sup> and January 1996,<sup>11</sup> respectively. These manuals contain many theoretical generalizations of how units should fight but are short on particulars. Relatively little has been done to update them.

Figure 1. Increasing system effectiveness.



The techniques of fighting in a degraded digital mode (back-up) are also lacking in digital doctrine. An analysis of back-up requirements specifically considered the potential impact of these requirements on collective tasks. Looking at the Army Training and Evaluation Program-Mission Training Plan (ARTEP-MTP) for tank platoon through battalion/task force operations, the study identified back-up

<sup>10</sup> U.S. Army Armor School (December 1995). The Digitized Battalion Task Force Headquarters, FKSM 72-2-1, Fort Knox, KY.

<sup>11</sup> U.S. Army Armor School (January 1996). Tactics, Techniques, and Procedures for the Digitized Company Team, ST 71-1-1, Fort Knox, KY.

implications for all of the ARTEP-MTP tasks. Doctrine writers need to be aware that all collective tasks in the digital domain need to be analyzed for back-up training requirements.

Developers of future doctrine need to consider that digital systems will affect how units fight. Some collective functions may be eliminated and new ones added: virtually all aspects of operations are subject to revision.

**ISSUE: The Army  
Does Not  
Have  
Doctrine for  
Fighting  
Digitized  
Units**

**RECOMMENDATION:**

**To maximize the full capabilities of digital systems:**

- **Ensure that doctrine development positions are filled by personnel with experience in digital and back-up operations.**
- **Address the concept of fighting doctrine very early in the acquisition process.**
- **Increase the use of simulation and simulators to first push the doctrinal envelope, and then to proof fighting doctrine.**
- **Discipline the existing system to ensure doctrine and training are fielded at the same time as the digital systems.**

---

**Doctrine Publication  
Cannot Keep Step  
with Digitization**

Despite advances made by making Army publications available over the Internet and by issuing editions on compact disk-read only memory (CD-ROM), the Army publication process is still essentially a paper-based production system. The cited advances speed up distribution but not production. Soldiers must have reliable, accurate, approved, and proven materials with which to work, but the rapidly changing needs of the digital environment cannot be accommodated by today's Army publication model.

The current Army method of conveying information to users has remained essentially unchanged since World War II. It involves a series of technical manuals (TM) for equipment operation, field manuals (FM) for operational guidance, and soldier training publications (STP) for critical task descriptions and individual training guidance. Training support packages (TSP) have been initiated in recent years to provide exportable materials that integrate training products, materials, and management for accomplishing critical training requirements. The common basis of all of these products is

*The current Army method of conveying information to users is essentially unchanged since World War II.*

that they must conform to the development requirements of TRADOC Regulation 350-70 (*Training Development Management, Processes, and Products*) which prescribes a very proceduralized life cycle for product development.

All documentation is subject to lengthy production and priority constraints under the Army-wide Doctrinal and Training Literature Program (ADTLP) for printing and product management. The result is less-than-timely literature. For example, the current official version of the ARTEP 71-2 MTP (*The Tank and Mechanized Infantry Battalion Task Force*) carries a publication date of October 1988. The STP, which define the critical skill domains for individual soldiers and their leaders, are equally affected--the STP for the 19K armor crewman is dated November 1989.

In the field of digital systems and operations, one year old operating systems are often outdated. In the case of the M1A2, there have been five software "drops" during the period from June 1995 (when the first tank was issued to a using unit) and June 1997. As systems proliferate and integrate, soldiers will be faced with the situation where change will be constant instead of cyclical and forecasted. Training requirements cannot be supported by the existing publication model.

**ISSUE: Doctrine  
Publication  
Cannot Keep  
Step with  
Digitization**

**RECOMMENDATIONS:**

- 1) Review and revise the existing model of documentation so that it can effectively and efficiently provide information to users in the digital Army.
- 2) Increase use of outsourcing, including systems contractors, to expedite the production and delivery of information.
- 3) Resource and maximize the use of information technologies and electronic media in the development, production, and distribution of information.

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## Digital Units Are Learning; Crosstalk and Feedback Among Units Is Lagging

*Very few digital procedures, techniques, policies, tasks, and standards for the M1A2 have been formalized.*

The Army's move to digitization is characterized by an increasing variety of systems, each developed and fielded independently. Because of low initial purchases or limited basis of issue (BOI), many of these systems are fielded in relatively low numbers. Units that have received new systems have adapted to their capabilities and, in effect, developed a pragmatic doctrine for employment. But this rich source of information is not being used to full advantage.

In mid-1995 the first M1A2 tanks were issued to units at Fort Hood, Texas. Equipment issue was accompanied by a new equipment training (NET) team but with minimal operational and employment guidance. What followed was a true discovery learning period on the part of M1A2 units. As units experiment and gain experience with digital operations they discover, and solve, many problems. These learning experiences range from equipment operation to tactics to back-up procedures. While some of these procedures are being incorporated into unit standard operating procedure (SOP), most became just a way of doing business. This knowledge is limited to a core group of mostly junior officers and noncommissioned officers (NCOs). Within units, Officer Professional Development (OPD) and NCOPD sessions serve to promulgate solutions. Outside of units, no similar mechanism for capturing this exists. Very few of these procedures, techniques, policies, tasks, and standards have been formalized. Fewer still have found their way back to the proponent institution charged with developing digital and back-up operational guidance.

Experience with the M1A2 is not unique in this regard. Anecdotal information out of the EXFOR AWE indicates many like instances of resourceful officers, NCOs, and operators developing innovative solutions to problems that systems developers did not even know existed. Examples cover the full range of performance such as button-pushing functions, overcoming system failures, and making entire operating systems work more effectively. Such experiences go far beyond the stated purposes of the experiments and beyond the formalized lessons learned that are often the cited outputs from these efforts. However, there is no formal mechanism established to systematically gather, analyze, generalize, and incorporate these experiences into a feedback process to other users. Notably, selected TRADOC schools have recently provided liaison personnel to gain from Fort Hood's digital experience.

**ISSUE: Digital  
Units are  
Learning;  
Crosstalk  
and  
Feedback  
Among Units  
Is Lagging**

**RECOMMENDATIONS:**

1) Institutionalize and formalize linkages between early fielding units and later fielding units. For example, develop and refine procedures with units fielding the M1A2 and pass the procedures on to units fielding the M2A3.

2) Formalize permanent linkages among units and proponents which will allow cross-feeding of digital operational discoveries. Such a system should provide for:

- Information flow in and out.
- Automatic periodic updates and notifications.
- Universal access by users at all levels.
- Free, informal information exchange in real time.
- Monitoring and overwatch.

3) Establish a protected website on the Internet in order to operationalize linkages among units and proponents. A pilot program for such a website is contained in Application B.

This pilot program addresses the need for M1A2 tank units and the proponent schools to input and access information on digital and back-up skills. Users will share information and lessons learned in order to maintain the ability to successfully fight the M1A2 under all conditions.

### Internet-Based Pilot Program

This proposed information sharing effort will have wide follow-on applicability to other digital systems throughout the Army. This Army-wide applicability underscores the requirement for the pilot program to be jointly developed by the Armor Center and the Army Training Support Center. Periodic program reviews, with full user representation, will facilitate tailoring the program to fulfill user needs.

Program Objectives	Operational Aspects
<ul style="list-style-type: none"> <li>● Provide current, on-demand information about digital and back-up skills to and between M1A2 units and the Armor School.</li> <li>● Demonstrate that this application of Internet-based technology is viable, relevant, and responsive to the needs of the force.</li> </ul>	<ul style="list-style-type: none"> <li>● This website will provide a single point of entry for M1A2 units.</li> <li>● Internet access will be made readily available to all units, and sufficient to enable on-demand access from any location.</li> <li>● Security "firewalls" will be put in place to preclude inadvertent dissemination of classified or sensitive information.</li> </ul>
<p><b>This proposed system will be:</b></p> <ul style="list-style-type: none"> <li>● Controlled by the U.S. Army Armor Center (to maintain unity of effort).</li> <li>● Based on the utilization of the Internet as the delivery means. This technology will ensure that any computer platform available to M1A2 crews will be able to access and fully utilize the site.<sup>a</sup></li> <li>● Accessible 24 hours/day, 7 days/week.</li> <li>● Maintained by contractor personnel and supervised by an Armor Center proponent.</li> <li>● Focused on the M1A2 tank units stationed at Fort Hood, Texas, initially.<sup>b</sup></li> <li>● Linked to other relevant websites; emphasis is on integration of and accessibility to the most current information.</li> </ul>	<ul style="list-style-type: none"> <li>● For safety reasons, the site will contain explicit cautions (e.g., to distinguish between "tips," doctrine, and SOP items from other units).</li> <li>● The website will be a "PULL" site for users seeking information and a "PUSH" site for providing rapid updates to the force on new digital and back-up information (e.g., newly developed TTPs).</li> <li>● Direct users to the most effective venues for additional information on digital and/or back-up techniques (e.g., CD-ROM, on-line, and printed publications; on-line interactive sites, etc.).</li> <li>● The website will provide on-line access to subject matter experts (SMEs) and mentors who possess specific expertise.</li> </ul>
<p><sup>a</sup> Minimum computer system requirements must be specified, but a wide array of systems are fully compatible with web-based technology.</p> <p><sup>b</sup> In the near future, the program will be expanded to include Fort Carson, Colorado (coincident with the fielding of the M1A2 Tank to the 3d Armored Cavalry Regiment).</p>	

Application B: Detailed recommendation for facilitating crosstalk and feedback among digital units.



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**Proponent  
Interaction Is Not  
Effective**

*There is too  
much commonality  
in the digital  
future to allow  
stovepipe  
developments to  
predominate.*

The armor and infantry communities are embarked on similar but differently timed efforts in the development and refinement of digital systems for the tank and infantry fighting vehicles. Because of habitual cross attachment requirements, no two systems share more operational commonality than these two. Although the design specifications for the M1A2 and the M2A3 stipulate engineering interoperability, the armor and infantry proponents have been slow to interface and share lessons learned on important aspects of training, how-to-fight doctrine, and back-up requirements.

The problem extends beyond the armor and infantry communities. There is a profusion of digital initiatives in various developmental and operational stages in the areas of fire support, intelligence, command and control, and combat service support. Not only will many of these systems eventually be required to interface, but there are many development, usage, and back-up problems that are being discovered independently and repeatedly.

The stovepipe operation of proponents is not the way to do business. A probable cause of this lack of informal coordination is the reduction in manpower and expertise at the individual proponents. However, it is exactly because of these reductions that it is essential to find an effective solution, without additional personnel demands. There is too much commonality in the digital future to allow stovepipe developments to predominate.

**ISSUE: Proponent  
Interaction  
Is Not  
Effective**

**RECOMMENDATIONS:**

- 1) Require formation of working groups of relevant proponent representatives focused on specific, shared issues (e.g., common back-up training requirements, common systems usage, common doctrinal publications).**
- 2) Maximize use of modern information technologies and electronic media to facilitate shared development issues.**

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## **Institutional Issues**

The system of service schools and proponents that evolved during the 40 years of cold war (and is embodied in the current TRADOC organization) served well a large, industrial age Army with a relatively clear strategic mission. Mainly because of resource constraints, that system is in the process of being dismantled and its mission redefined. What will emerge is not yet clear; much will be driven by changes in other spheres. There are two distinct digital and back-up issues that are identified with the institutional role in training soldiers.

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### **Resident Instruction Must Address Digital and Back-Up Training Requirements**

Just as resources are getting tighter, the Army is faced with increasing training demands generated by the advances in digitization. The transition to digital operations will be characterized by an assortment of digital, part-digital, and non-digital equipment. Rapid changes in technology also compound the institutions' instructional role. Since many institutional courses are traditionally equipment oriented, TRADOC must re-look the way it prepares its soldiers. Teaching multiple systems is an inefficient and expensive approach to the problem. Given that resources, particularly time, are an ever precious commodity, institutions must carefully analyze their missions and capabilities and determine how digital and back-up training will best take place.

*Computer skills  
training and  
understanding of  
systems will  
become a  
component of  
being a soldier.*

The typical approach to specialized training needs has been to add institutional courses that deliver the required training. An example is the 40-hour add-on course for the M1A2 at skill level (SL) 1. While this course has fulfilled a very vital role in preparing soldiers to go to M1A2 units, it may not be the most responsive way to address unit needs for entry level soldiers. And add-on courses for low density systems are not a very cost-effective way to train soldiers. Unit training may be an alternative for all or part of this training.

At the same time, there are roles that only the institution can fulfill. Key aspects of "soldierization" can only be effectively instilled in individuals in the atmosphere of resident instruction. Many simulators and training devices only become cost-effective when they are centralized in high-use locations, rather than when they are dispersed and ineffectively utilized.

Computer skills training and understanding of systems will soon become a fundamental component of being a soldier. There is an underlying assumption that everyone under the age of 25 has these skills, but that may not prove to be the case. Increasingly, the

institution may find itself in the role of teaching basic operating skills rather than focusing on equipment specific skills.

**ISSUE: Resident  
Instruction  
Must Address  
Digital and  
Back-Up  
Training  
Requirements**

**RECOMMENDATIONS:**

1) Performance requirements for digital systems must be analyzed. Institutions must define the digital and back-up skill training requirements (e.g., examine the sequence and mix of training for digital skills and back-up skills).

2) Institutions must determine which soldiers should possess what digital and back-up skills. In other words, match skill needs with soldiers' future assignments.

3) Apply high transfer training strategies and procedures for computer literacy and hands-on skills.<sup>12</sup>

4) The appropriate training environment (institution, unit, self-development) must be determined for learning the domain of digital and back-up skills. Criteria for making this determination must include such considerations as resources, system densities, skill retention factors, and system upgrade rates.

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**The Institution's  
Current Role Will  
Be Outmoded for the  
Digital Army**

Except for imparting soldierization skills at initial entry training (IET) and where required by law, the institution is undergoing a fundamental change in its mission. Some of this is being dictated by the realities of budget and downsizing, but much is the result of the changing nature of the Army, typified by the impact of digitization. As the Army incorporates a larger variety of equipment (digital, non-digital, part-digital) into its force mix, the training of specific systems at a central location becomes a less efficient method of producing soldiers with the right skills at the right time. Also, because of the rapidity of systems development and upgrade, the present method of centralized training can only keep a small portion of soldiers current.

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<sup>12</sup> Finley, D. L., Sanders, M. G., & Ryan, A. J., III (1996). "Application of training transfer principles in developing the high transfer training (HITT) methodology." Innovations in Education and Training International, Volume 33, Number 4, pp. 232-239.

*The entire concept of training needs to change from course-oriented to mission-based training. . .*

However, shifting course requirements from the institution to the unit will not be a simple solution. Units currently face a variety of missions conducted with a variable array of equipment and forces. This dynamic situation is likely to continue. Therefore, the entire concept of training needs to change from course-oriented to mission-based training focused on specific equipment. For example, future training events may need to focus on a specific deployment (e.g., Southwest Asia) for a particular mission (e.g., defense-urban combat) for particular equipment (e.g., SEP-conventional mix). Units will need institutional support and assistance if they are to successfully increase their training load.

Specifically, the requirement is for a wide variety of training tools for both individual and collective training. These tools should reside in "libraries" that can be quickly accessed by units, or can be quickly produced and dispatched to meet a particular training need. Materials must be complete, accurate, timely, and validated as effective. This is a substantial shift from the institution's current role and it cannot be met by simply converting existing courses to an export medium. The requirement is for tailorable training. Institutions will be required to radically rethink the way they do business to meet this need in the near future.

**ISSUE: The Institution's Current Role Will Be Outmoded for the Digital Army**

**RECOMMENDATION:**

The primary mission of institutions must undergo a fundamental change in order to fulfill digital and back-up training requirements. The institutions must change from conductors of training to exporters of training.

- The training strategy must emphasize the exchange of information between units and the institution.
- Training must be mission-based and focus on specific equipment.
- The training must be developed by the institution (much of it under contract) and then exported to units. The training support package must allow units flexibility in its application. An example of how such training can be developed is detailed in Application C.

### **Commander's Integrated Training Tool (CITT)**

The Program Manager and TRADOC Systems Manager for Combined Arms Tactical Trainer are exploring the structure and utility of a Commander's Integrated Training Tool (CITT) for the Close Combat Tactical Trainer (CCTT) simulation system. The CCTT provides combat vehicle simulator modules and workstations to train armor, armored cavalry, and mechanized infantry units. Emerging capabilities of CCTT include conventional and digital simulation elements. With the use of previously developed training support packages (TSPs), units can practice command and control, the decision-making process, and maneuver tasks at the platoon through battalion task force level.

As tools, techniques, and procedures unfold for CCTT training, a method is being developed to provide commanders and other unit trainers a way to effectively utilize these new training resources. The CITT tool should help ensure a proper balance of field and simulation training as prescribed by the Combined Arms Training Strategy (CATS).

#### **CITT Features**

The CITT is intended to enable commanders and unit trainers to make optimal use of CCTT. By means of PC-based or Internet-based tools, CITT will assist users in five ways:

- 1** Provide a gateway to CCTT information, including descriptions of CCTT functions and capabilities and access to PC-based training on CCTT workstations and manned modules
- 2** Provide a reference library of available exercises and associated TSPs that contains:
  - Identification of target training audience and specific tasks trained with each exercise
  - Specifications of time and support (personnel) requirements for each exercise
  - Description of the mission and major events contained in each exercise
  - Methods for downloading an appropriately configured TSP for conducting selected exercises
- 3** Provide methods for making modifications to existing exercises and associated TSPs:
  - Make "search-and-replace" changes to tailor unit designations, times, call signs, etc.
  - Assist the user to keep the TSP materials internally consistent by pointing out or flagging components that are affected by changes in locations, sectors, task organization, etc.
- 4** Provide guides and "wizards" to assist users in preparing new exercises and TSPs, with the ability to use selected components of existing TSPs as appropriate
- 5** Provide information to trainers on using CCTT for digital training

**Application C:** A model of an exportable tool that allows unit trainers to utilize existing training exercises or tailor exercises according to specific training needs.

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## Unit Issues

Units have habitually borne the bulk of the training load along with operational requirements. But the drawdown of forces coupled with ever changing geopolitical strategies and multi-echelon deployments have profoundly affected how units operate. Like institutions, units will have a new training role in the digital Army. Two specific issues are explored.

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### Units Are Not Prepared for the Added Training Load of Digitization

*Because of the differences in equipment and the rapid changes in technology, most digital and back-up training will fall in the unit sphere.*

A benefit of digitization is that it will lead to the automation of many tasks which are currently performed through manual or operator-intensive means. This should simplify the demands on the soldier. But that is the future--the transition period will have just the opposite effect. During this extended transition period, the mix of forces and equipment reliability issues will increase the domain of skills that soldiers will need in order to operate. Because of the differences in equipment and the rapid changes in technology, most of this training will fall in the unit sphere. Units traditionally have responsibility for some initial skill training, all sustainment training, and all collective training. That responsibility will not change, but the requirement for digital and back-up skills will alter the complexion of unit training.

Ever since the decentralization in the early 1970's, unit training has been marked by inefficiencies. These include lack of planning skills, insufficient training tools, poor organization of training, improper utilization of personnel, and irrelevant training content. The result is wasted training time. If the units are to pick up additional training requirements in the digital and back-up arena (and this is a foregone conclusion) then such inefficiencies must be identified and eliminated. The entire unit training strategy from the mission essential task list (METL) concept to mandatory classes to training management must be re-evaluated and revised.

Shifting more training requirements to units must not be a patchwork approach nor can it be done without full realization of the areas where units are inherently weak. These include the areas of personnel turnover and shortages, lack of training design expertise, difficulty of integrating training with other activities, inexperience in training management, nonstandard and competing missions, and inflexibility in changing from current training models. The Army must accept that unit training loads are going to be increased and must find a way to accomplish this, without relying on a "more of the same" approach.

**ISSUE: Units Are  
Not Prepared  
for the Added  
Training Load  
of Digitization**

**RECOMMENDATIONS:**

- 1) Determine the most effective and efficient balance between the decentralized model of unit training and a more controlled approach.
- 2) Realistically appraise the preparation and delivery of unit training. Identify and provide the necessary training tools.
- 3) Develop more effective training links between units and institutions.

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**Units Need Soldier  
Assessment  
Capabilities**

*Units need  
efficient  
methods to  
assess soldier  
skills:*

- *skill profiles  
for each soldier*
- *Assessment  
tools for  
digital and  
back-up skills*

In the early 1980s, armor crewmen in SL 1 through 4 were responsible for 200 individual tasks.<sup>13</sup> In 1996, armor crewmen in the same SL had a task domain of 567 individual tasks.<sup>14</sup> Moreover, the earlier list reflected operation on three different types of tanks while the 1996 list reflected primarily operation on the M1A1 tank. The digital soldier will be faced with an even more complex array of task requirements for digital and back-up operations on an increasingly wider array of equipment. How realistic is it to assume skill mastery on the current list, much less on an expanded and perhaps ill-defined list?

When soldiers are newly assigned to a unit there are generally two widespread approaches to assimilation. The first (often applied to officers and NCOs) is to assume that the soldier is more knowledgeable than he or she actually is. The second (often applied to junior enlisted) is to assume the soldier knows next to nothing. Very often, both approaches will be ongoing simultaneously within a unit. Both approaches are ineffective and inefficient.

Two needs are apparent. First, soldiers need to come to a unit with a profile that reflects their training, equipment and operational experience, and skills inventory and mastery. Old systems such as the Job Books were inaccurate and did not work. New systems such as the Army Company Information System (ACIS) need to reflect more than just formal training records. The profile must be accurate, descriptive, and easy to use and interpret by first level supervisors. Moreover, it must be specifically tailored to meet the expanding

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<sup>13</sup> Department of the Army (July 1982). M48-M60 Armor Crewman Soldier's Manual, FM 17-19E1/2/3/4, Washington, DC.

<sup>14</sup> Department of the Army (July 1995). Master Task List, CMF19/BC 12, Fort Knox, KY: U.S. Army Armor School.

digital and back-up domain.

Secondly, units must have a quick, reliable internal assessment tool for digital and back-up skills. The model of the current Tank Crew Gunnery Skills Test (TCGST) is a start point because it is both standardized and current. A similar tool, customized to specific digital systems and operator levels, would provide units the capability for conducting initial and periodic assessments. Such an instrument or set of instruments must be reliable, current, standardized, and easily administered and scored. Unlike the TCGST, it may need to go beyond the assessment of discrete skills. An early experience of working in a digital environment led one leader to observe: "Training with information systems increasingly demands innate intelligence and computer literacy, so that soldiers can accommodate changes, so they can handle rapid operations, and think on their feet. The M1A2 task force will place continuing emphasis on quality training of quality soldiers."<sup>15</sup>

**ISSUE: Units  
Need  
Soldier  
Assessment  
Capabilities**

**RECOMMENDATIONS:**

**1) Begin a pilot program that tracks M1A2 crewmen skills. A goal should be to adapt and apply the program to the M2A3. Such a program should:**

- Identify the realm of digital and back-up tasks.
- Explore technology for recording and transmitting individual skills data.
- Identify unit needs and uses of information.
- Track personnel across assignments.
- Evaluate the effectiveness of a tracking system.

**2) Develop and pilot a digital and back-up skills test, based on the M1A2. Evaluate the concept and expand to other digital systems and applications.**

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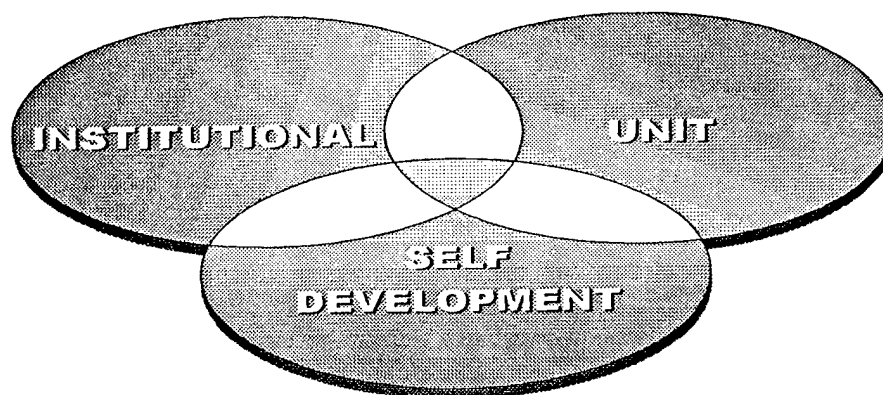
<sup>15</sup> Nowowiejski, D. A. (January-February 1995). "Achieving Digital Destruction: Challenges for the M1A2 Task Force." Armor, p 24.



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## Training Pillar Issues

Over the years, the Army training paradigm resulted in three pillars, each supporting an area of training. These included the two predominant areas of institutional training and unit training, and the less emphasized area of self-development training. The three areas will be redefined in the future, with much less distinctiveness. Our examination of digital and back-up requirements identified two training pillar issues that deserve attention.



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### There Is No In-Depth Plan to Integrate the Training Pillars

A shift of responsibilities and functions between the existing training pillars is a reality of Force XXI training. The Army Distance Learning Plan (ADLP) makes it clear that the goal is to deliver training on-demand, where and when it is needed. The plan states: "The three traditional training pillars (institutional, unit, and self-development training) will merge, placing greater emphasis on unit and self-development training."<sup>16</sup> In other words, institutional-based training will decrease and units or learning center settings will pick up the slack. However, each of the existing pillars has fundamental characteristics that typify it. These characteristics must be considered during the development of training strategies and the assignment of responsibilities. A coordinated effort is necessary, otherwise the result may be chaotic.

*Digital and back-up requirements must be included in any realignment of training responsibilities.*

As institutions cut back on their training, the effect will be a unilateral transfer of training responsibilities. However, there is currently no system in place to ensure that the merging of the pillars will be accomplished multilaterally, effectively, and responsibly. This is a high risk venture; if not properly integrated the outcome could be a breakdown in training of soldiers and units.

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<sup>16</sup> Department of the Army (3 April 1996). Army Distance Learning Plan. Fort Monroe, VA: Training Development and Analysis Directorate, para. 1-6.

Where does the training for digital and back-up requirements fit into this merging training structure? The total impact of digital and back-up training requirements has not yet been fully felt, because digitization currently affects only a small part of the force and because some training requirements are not yet addressed (e.g., back-up requirements). But digital and back-up requirements must be included in any realignment of training responsibilities.

**ISSUE: There Is  
No In-Depth  
Plan to  
Integrate the  
Training  
Pillars**

**RECOMMENDATION:**

Develop a detailed plan for digital and back-up training that establishes policies and procedures for integrating self development, unit, and institutional segments of training. Such a plan must:

- Establish authority and responsibility.
- Ensure compatibility between efforts.
- Require that the impact of transferring training from one pillar to another is evaluated.
- Direct that training effectiveness be the primary criterion for allocation of training.
- Maximize the use of electronic media.

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**There Is No  
Comprehensive Self -  
Development Plan**

*Until the Army  
defines the role  
of self-  
development. . .  
any plans to  
take self-  
development  
beyond its  
current state  
cannot succeed.*

Self-development is continuously cited as an integral part of the Force XXI training program and is specifically projected as a way for soldiers to acquire and maintain digital and back-up skills. However, the concept is undeveloped. There is no plan detailing how self-development training initiatives will be developed, implemented, or evaluated. The ADLP contains few references to self-development. For example, it states that "WARRIOR XXI is the institutional and self-development component of AT XXI" and that the ". . . (student) group consists of soldiers voluntarily pursuing self-development training and education."<sup>17</sup> But there is no overarching strategy that specifies how this will work.

Historically, the Army's self-development pillar has not been robust. It consists of primarily independent, proponent-specific correspondence course programs, a reading list for junior officers, and a broad blanket inclusion of civilian education pursuits facilitated by Army endorsements and accessibility. The Army Correspondence

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<sup>17</sup> Department of the Army (3 April 1996). Army Distance Learning Plan. Fort Monroe, VA: Training Development and Analysis Directorate, paras. 1-9, 2-5.

Course Program (ACCP) has never been relied on for job skill acquisition and has had a distinct RC focus. The ACCP is primarily an adjunct to institutional courses, designed to “help bridge the training gap between resident courses, aiding in sustaining skills/knowledges.”<sup>18</sup> This is quite different from the role envisioned in the future where self-development will have a predominant place in acquisition and sustainment of digital and back-up skills.

Until the Army defines the role of self-development and develops a cohesive and comprehensive self-development strategy, any plans to take self-development beyond its current manifestation cannot succeed.

**ISSUE: There Is  
No  
Comprehensive  
Self-  
Development  
Plan**

**RECOMMENDATION:**

**Define a self-development strategy that addresses digital and back-up issues. The strategy must address:**

- **How the content for self-development training will be determined.**
- **Who will develop, monitor, and manage self-development programs.**
- **Where the time for self-development training will come from.**
- **What incentives will be offered for soldiers to complete self-development programs.**
- **How digital and back-up skills and knowledges will be evaluated.**

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<sup>18</sup> Department of the Army (24 September 1995). TRADOC Regulation 350-70, Fort Monroe, VA, p. VI-9-3.

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## Strategic Analysis Issues

Examination of existing digital operations and generalization to a coming digital Army reflects a system that is potentially so pervasive that there is little in the Army that will not be affected by it. The issues run from the simple to the complex. While all issues require more detailed analysis than this study was intended to explore, there were three issues that are, in themselves, predominantly analytic problems.

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### Training Will Not Solve All Digital Problems

*Training as a solution will be effective only if applied in conjunction with other solutions and used in areas where it is most effective.*

Currently, the Army has no overall plan for what role training can best fill in the digital and back-up operational scheme. The current study was specifically directed at training and did not focus on non-training issues. But training as a solution will be effective only if applied in conjunction with other solutions and used in those areas where it is most effective. Training is too expensive, too cumbersome, and too unreliable to be the only approach considered.

This study did not address the compendium of non-training solutions. But during the course of pursuing the training issues, some related areas were identified. In the equipment field these include improved system reliability, system redundancy, and substitution of cheap digital systems as a link between full digital and manual back-up capabilities (e.g., precision lightweight global positioning system [GPS] receiver [PLGR]). In the personnel field, non-training solutions include improving personnel selection and classification, and revamping utilization and assignment policies. Finally, in the operational field is the requirement to determine risk assessment and risk tolerance for deferred or delayed training. Training should not be viewed as the sole solution to digital and back-up issues.

**ISSUE: Training  
Will Not Solve  
All Digital  
Problems**

### RECOMMENDATIONS:

1) Conduct analyses to determine where training is the most effective solution to digital and back-up problems. The role of training must be considered as only one of several possible solutions.

2) Explore other solution sets to be considered as adjuncts to training solutions. They should include the following six questions:

- How should the personnel selection and classification system be used to match soldiers to digital jobs?

- How should the personnel assignment system be refined to insure soldiers with digital skills are identified, stabilized, tracked, and assigned?
- Which digital capabilities should be backed-up with redundant systems rather than with manual back-up skills?
- What alternative technologies should be developed to replace manual back-up requirements?
- What risks are acceptable if systems fail and no back-up is available?
- What operational solutions--for example in changes to unit operations--can back-up digital performance?

### Effects of Distance Learning on the Army Are Largely Unknown

*Extensive study is necessary to determine how current training methods will be transferred to distance learning modes.*

Distance learning has been proposed as the answer to many of the Army's training issues resulting from increasing training demands and decreasing resources. Yet a multitude of unanswered questions exist concerning distance learning and how this relatively untapped mode of training will be implemented. In the ADLP, the definition of distance learning is "... the delivery of standardized individual, collective, and self-development training to soldiers and units at the right place and right time through the application of multiple means and technologies."<sup>19</sup>

How current training will be transferred to distance learning modes remains to be determined. For instance, transferring lecture instruction, paper-based instruction, and hands-on instruction all require different strategies and resources. If distance learning is to become a primary resource for training digital and back-up requirements, then the Army must address some of the issues associated with this training environment. A sample of these questions are:

- What types of skills can be trained via distance learning and what skills must be trained in residence (e.g., cognitive skills, motor skills, psychomotor skills)?
- Who will be responsible for converting existing training programs to distance learning media?
- How will distance learning training be managed?

<sup>19</sup> Department of the Army (3 April 1996). Army Distance Learning Plan. Fort Monroe, VA: Training Development and Analysis Directorate, p. 1.

- Who will maintain the database (i.e., central database or proponent database)?
- How will student participation and evaluation be measured?
- What is the feasibility of updates for different media?
- How will the Army evaluate whether distance learning accommodates different types of learners (e.g., computer literate or not)?
- How will soldiers be motivated to use distance learning?
- How much time does it take to convert existing training materials to distance learning training?
- Is distance learning as effective as conventional training?
- How will updates to the distance learning programs be implemented?

**ISSUE: Effects of Distance Learning on the Army Are Largely Unknown**

**RECOMMENDATION:**

**Conduct a thorough assessment of distance learning implications:**

- Include pilot trials to determine effectiveness of distance learning for different skills training.
- Establish and enforce the policy that distance learning decisions will be based on demonstrated training effectiveness in meeting standards and on cost savings.

**Effects of Skill Decay on Digital and Back-Up Tasks Are Unknown**

A research area with a high potential for payback concerns the skill decay characteristics of military tasks. While there have been some advances made in this area,<sup>20</sup> there are significant explorations that need to be undertaken. The potential for application is immense: If sustainment and retraining of tasks were based on known factors and conditions of decay and performance, the savings in training efficiencies would be significant.<sup>21</sup> Moreover, the impact of skill decay on combat effectiveness and mission accomplishment is incalculable. There is currently inadequate information on which to

<sup>20</sup> Wisher, R. A., Sabol, M. A., Sukenik, H. K., & Kern, R. P. (June 1991). Individual Ready Reserve (IRR) Call-up: Skill Decay (ARI Research Report 1595). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

<sup>21</sup> "PRACTICE: The Foundation of Training" (Spring 1995). ARI Newsletter, pp. 9-10.

and retraining of digital and back-up skills.

*"Digital skills are relatively perishable! crews must practice continually to attain default proficiency."*

-- MAJ Edwards III

Back-up skills by their very nature are a unique skill area. By definition they are sporadic, infrequent, isolated, and often occur under circumstances of stress. Even if the back-up task is the same as a manual task, the conditions for back-up performance, including the recognition of when it is necessary, can have a profound effect on recall and sustainment training. Moreover, human skills and modes, such as decision-making and voice communications, may set the conditions for digital task performance. There is not currently an effective model of this type of behavior that fits the military setting.

Digital skills are a new area for the Army. To start with, there is no definition of digital skills or inventory of proficiencies or knowledges that are expected of soldiers in a digital environment. Anecdotal reports indicate that digital skills may require special treatment. An officer at an NTC rotation for digital applications observed: "Digital skills are relatively perishable! Crews must practice continually to attain default proficiency."<sup>22</sup> However, little empirical evidence has been obtained on learning, sustaining, and forgetting in the conditions under which the Army operates. While the advantages of digital operations are substantial, they can be negated if operator failures are frequent or at critical junctures.

**ISSUE: Effects  
of Skill Decay  
on Digital and  
Back-Up  
Tasks Are  
Unknown**

**RECOMMENDATION:**

1) Pursue research to determine skill decay of both digital and back-up tasks with a focus on the operational conditions of employment. Develop models for maintaining proficiency, retraining, and relearning of digital and back-up skills. Skill retention effects should drive future training strategies for digital and back-up training.

2) Extend work on practical guides for retention training<sup>23</sup> to digital skills and back-up skills for more efficient training management.

<sup>22</sup> Edwards, O. T, III (May-June 1995). "Digital battlefield training and insights of a user (NTC Rotation 94-07)." *Armor*, p. 13.

<sup>23</sup> Wisher, R. A., Sabol, M. A., & Ozkaptan, H. R. (May 1996). Retention of "Peace Support Operations" during Bosnia deployment: A basis for refresher training (ARI Special Report). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

## SUMMARY AND CONCLUSIONS

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### Summary

The effects of digitization are profound. Eventually, many tasks that once were done manually will be done automatically, with greater accuracy, and in a fraction of the time, than was ever envisioned a few years ago. But the move towards digitization is generating new skill demands and, consequently, the need for new training strategies and designs. Early identification of training and personnel issues is essential to ensure that long-term program costs are minimal and roadblocks to implementation of needed changes are avoided.

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### Conclusions

To ensure a viable and productive transition to digitization, the Army must:

- **Develop a back-up training strategy.** Digital and back-up development must go hand in hand. Back-up must be integrated into the process that derives digital training and digital strategies (see Application A).
- **Align the systems acquisition model with information age development.** Rapid changes are a trademark of digital technology. The acquisition model, and in particular those parts of it concerned with training identification and development, must match the speed and complexity with which technology evolves.
- **Develop digital doctrine to match digital technology.** New doctrine must be in place to guarantee that increases in capabilities are supported by appropriate doctrine. Soldiers must not be required to fight 21<sup>st</sup> century technology with 20<sup>th</sup> century doctrine.
- **Ensure that knowledge transfer matches digital developments.** The publications model of providing information to soldiers through TMs, FMs, ARTEP-MTP, etc., must be critically examined and eventually streamlined. The fast-paced changes that are predicted for digital development demand a publication system to match.
- **Improve information to and from the soldiers who make a difference.** Units that field new digital systems are gold mines of "how-to" information. Steps must be taken to institutionalize and formalize direct linkages between early fielding units and later



fielding units. A pilot program to explore this should be a high priority to guarantee that a workable system is in place as digital systems proliferate (see Application B).

- **Eliminate stovepipe developments.** Digital capabilities cross traditional proponent venues. Where digital interests are shared, a proactive program must be in place to make sure development efforts do not duplicate work being performed by others.
- **Define the institutional role in training digital skills.** Low density digital equipment and rapid changes in technology make it more difficult for institutions to teach system-specific skills in resident instruction modes. Analysis must identify what institutions should teach and how they should teach it.
- **Require institutions to export their training.** Mixes of digital, part digital, and non-digital forces will need corresponding mixes of training packages for individual, crew, and collective tasks. The demand for tailored training packages to be delivered in units must be met by the institutions (see Application C).
- **Improve unit efficiency to prepare for increased training loads brought on by digital and back-up requirements.** Unit training has to become both more effective and efficient to meet increased digital demands. The existing model of unit training must be critically scrutinized and revised to meet digital conditions.
- **Develop management and assessment tools for digital soldiers.** Digital soldiers of the 21<sup>st</sup> century need to be managed like aircraft crew soldiers of today are. Programs of evaluation, certification, tracking, and utilization need to follow.
- **Devise a plan to integrate the training pillars.** There will be increased mixing of institutional, unit, and self-development training activities. But this must be done carefully and according to a plan that insures the effects on soldiers are known and understood.
- **Develop a self-development strategy.** Self-development training has potential for enhancing the options available in the requirements to train digital skills. It also has some pitfalls. A plan must define how self-development will fit into the overall training scheme.
- **Consider non-training digital solutions.** Training as a solution to digital problems is only practical if considered as one of a range of options. Training must be combined with other solutions to be most effective.

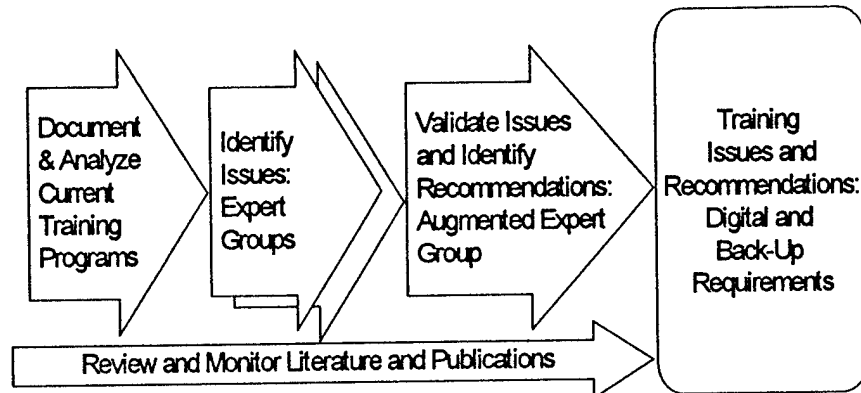
- **Do not lose sight of goals when embracing distance learning as a training option.** Distance learning shows great promise to reduce training costs, standardize training, and increase training availability. But training effectiveness is still the primary criteria.
- **Study skill decay of digital and back-up task.** Little is known about skill retention, particularly in the digital area and under the conditions the Army applies digital and back-up skills. More knowledge will allow better informed sustainment and retraining strategies to be developed.

# METHODOLOGY

## Study Method

To determine the effects of digitization on training, the study used two approaches: examination of existing program documentation and collection of input from experts. Figure 2 illustrates the methodology that was used. The process is described in detail below.

Figure 2. The study method.



Defining how digitization affects training the force necessitated an assessment of needs and the capabilities of the existing training base, and the identification of new skill requirements for all levels of performance.

The existing armor and infantry training bases were examined to see if means and resources (existing and projected) are adequate to support both digital and back-up training requirements. This process included documentation of the present training programs for soldiers and leaders; a thorough review of existing M1A2 digital tasks, both individual and collective; and an analysis of the back-up requirements, individual and collective, that are necessary when M1A2 digital systems cannot be fully utilized.

Throughout this study current literature and publications were reviewed. Topics monitored included Army training, future plans (e.g., ADLP), digital experiments (e.g., AWEs), and additional digital system developments. Several issues and problem areas were identified as a result of these reviews.

However, the majority of the discussion points in this report focus on strategic level digital and back-up training issues. These issues were identified in the course of expert group discussions involving individuals who were in, or had recently been in, positions closely affiliated with digital training. Two such groups of experts were

assembled. The first group met at Fort Knox, Kentucky in November 1996. Panel members included military and civilian personnel with background in armor operations and special expertise in digital operations, training development and research, training technologies, NET, institutional and unit training, and Army doctrine and trends. Their mission was to generate a listing of the most significant digital training issues and requirements.

The second group met at Fort Benning, Georgia in April 1997. Again, participants included military and civilian experts in the areas listed above, although their backgrounds were primarily in infantry rather than armor. Their objectives included validation and clarification of the issues and requirements identified by the first group, as well as augmentation of the list based on their own experience and background.

Once those issues had been defined and researched, a third group of experts was assembled to validate the digital and back-up issues and recommend solutions. This group was similar in composition to the first two groups, representing backgrounds in both armor and infantry operations, digital operations, Army doctrinal matters, and institutional and unit training. Additionally, the group was expanded to include targeted expertise in training technologies, distance learning, skill retention, and learning theory. The group included representatives from TRADOC, the Defense Advanced Research Projects Agency (DARPA), the Armor Center and Infantry Center, 1st Cavalry Division, the M1A2 NET Team, Force XXI Training Program, the Institute for Defense Analysis, and ARI. Meeting for two days in July 1997, the group discussed each issue and the associated indicators and provided the input used to formulate the recommendations contained in this impact study report.

## ACKNOWLEDGMENTS

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This work was performed by the Human Resources Research Organization (HumRRO) as part of their Advanced Distributed Training Program located at Fort Knox, Kentucky. Ms. Charlotte Campbell was Program Manager and her contributions to this project went far beyond project supervision. She was involved in all project decisions, participated in various workshops, and served as a reviewer of this report.

Colonel (U.S. Army, Retired) Michael (Mike) Shaler was the Project Leader, performing in this capacity while on Special Consultant status with HumRRO. Colonel Shaler was responsible for accomplishing the goals of the project, in line with the direction provided by the contracting officer's representative (COR) from ARI. He performed in all aspects of the project: serving as facilitator for the work groups; conducting visits and interviews; and contributing to this report. Three full time HumRRO employees completed the study staff: Mr. Roy Campbell, Dr. Laura Ford, and Mr. Robert (Mike) Cobb.

The COR for the project was Dr. Barbara Black from the Armored Forces Research Unit (AFRU), ARI, at Fort Knox. Dr. Black was an active member of the project in all aspects of the study, providing input and counsel throughout. She was a full participant in the study workshops. Also from the AFRU was Dr. Carl Lickteig, who served as the project Assistant COR (ACOR) and provided a working liaison to the project staff. Ms. Margaret (Marnie) Salter, from the Infantry Forces Research Unit (IFRU), ARI, at Fort Benning, Georgia also served as a project ACOR. She was also a full participant in all aspects of the study, most notably as the guide and counsel during the infantry related parts of the study. A report prepared by Salter and Black (in preparation) titled *Back-up Training Requirements for the Digitized Battlefield: An Overview* serves as the basis and framework under which this study was conducted. In their report, Salter and Black address the background and the broad implications of digitization. The fourth ARI participant who deserves special recognition is Dr. Kathleen (Kathy) Quinkert, AFRU. As head of the AFRU Future Battlefield Conditions Team, she participated in the workshops and provided an invaluable link to other related work efforts.

The findings and recommendations in this study were facilitated by the proceedings at three separate work groups conducted at Fort Knox, Fort Benning, and in Louisville, Kentucky. These workshops were only possible because of the 45 people, representing all Army interests, who voluntarily participated. It is primarily their candid, straightforward, realistic, and sometimes visionary ideas and observations that are represented in this report. Their participation was supplemented by input and interviews with soldiers and civilians from Fort Hood, Texas; Fort Leavenworth, Kansas; Fort Monroe, Virginia; Fort McPherson, Georgia; and within various Army activities in Washington, DC and Alexandria, Virginia. Everyone contacted was helpful and forthcoming. No one requested anonymity for his or her views; only the number, and the concern of omitting someone, precludes listing them by name. To everyone whom we contacted, the study staff is profoundly indebted.

Mr. Daniel (Dan) Deter (Colonel, U.S. Army, Retired) of HumRRO served as a special resource for this project. Despite his full time commitment to other projects, he made time to mentor and provide input on a regular basis as well as to participate in the workshops. This report reflects input from his review.

The final draft of this report was reviewed by senior officers from the Armor School, the Infantry School, Forces Command, TRADOC, and Total Army Personnel Command.

The cover design for this report was created by Mr. Wil McMillen, Graphics Artist for HumRRO. He also prepared the charts and figures in the report.

The report was composed and compiled by Laura Ford and Roy Campbell of HumRRO using input from everyone above.

Although we tried, we were unable to identify the name of the soldier depicted on the front cover. Even though he remains anonymous, he deserves our maximum recognition--he is the reason the study and this report are important.

*Roy Campbell*  
*Laura Ford, Ph.D.*  
*HumRRO*  
*Radcliff, Kentucky*  
*May 1998*